DRILL HIL TESTING
Verification and testing of control system software with Marine Cybernetics services

A modern drill floor consists of sophisticated computer-controlled drilling machines, often delivered by several suppliers. Failures in the control system software affects safety and leads to unproductive periods. Drill hardware-in-the-loop (HIL) testing by DNV GL is the answer.

The scope of Drill HIL testing is to detect hidden software errors, erroneous configuration parameters and design flaws in the drilling control system software before it is put into use on board the rig. Functionality and failure-handling capability in single machines, integrated functions, automatic modes and the anti-collision system is extensively tested using state-of-the-art HIL testing technology.

Why do we test?
Failures in the drilling control system affect safety, result in less profitable operations and increase the risk of unproductive periods. Automatic drilling systems are advanced computer-controlled systems that rely on software to function properly. This means that control system software from several suppliers must run and work together as an integrated system in order to maintain safety and achieve the desired operational performance. Drill HIL testing will prevent such failures and ensure a more reliable system.
How do we test?
The drilling control system is tested in a virtual test bed in a HIL test lab, using sophisticated HIL simulators of the drilling equipment. For each drilling machine, the HIL simulator known as CyberSea, which we developed ourselves, responds to the commands from the drilling control system in a realistic manner, and feedback from sensors and actuators to the control system is simulated according to the project-specific equipment. The control system responds as it would in real operation on board the rig. Functionality, failure handling capability and safety-critical software barriers can then be tested systematically in a controlled environment.

CyberSea includes models of the hydraulic systems, the electrical systems, the mechanical systems, encoders and relevant sensors for all the drilling machines in the test scope. This enables efficient testing of system interfaces and integrated functionality between different vendors.

Life-cycle services
The lab set-up established in the project may be used to provide life-cycle services for the drilling control system:

Software updates may be thoroughly tested in a controlled environment before they are installed on the vessel or rig, verifying that the update is according to specification and does not introduce unexpected problems into the integration process with other systems.

Installation of new equipment or machines may be tested together with existing equipment to verify proper integration before they are installed on board the vessel or rig.

Test scope and simulation scenarios
Functional testing covers verification of control system functions and modes for single machines, such as the operator station and panel interlocks, the normal operation of machines, mode change control, command abortion/cancellation and emergency stop functions.

Failure testing covers testing of control system failure detection, handling for single machines, failure handling for integrated machine operations and anti-collision functionality. Failure testing includes single and multiple errors such as sensor drifting, protocol errors, feedback and command signal failures, signal freeze, and electric, mechanical and hydraulic failures.

Integration testing covers integrated machine operations such as trip in and trip out, sequence control modes and interlocks between different machines. Anti-collision functionality, such as preventing machines from entering other machine zones, stopping machines if other machines are entering the zone and overriding functionality, is also tested.

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